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# Silver Creek Watershed

## TMDL Load Reduction Alternatives Assessment and Analysis

Conceptual Monitoring Plan

[redacted]

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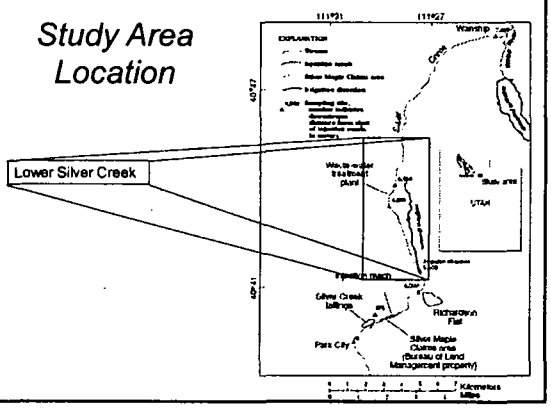
## *Presentation Outline*

- Project Goal
- Project Objectives
- Potential Types of Cleanup Options
- Project Constraints
- Data Requirements
  - Nature & Extent of Contamination
  - Design Development
  - Effectiveness Evaluation

## *Study Area Location*




## *Issues*

Mine wastes in lower Silver Creek:

1. Contribute to exceedance of zinc and cadmium aquatic life standards in Silver Creek.
2. Exceed the lead level developed for sediment in the Richardson Flat ROD.
3. Lead and arsenic soil concentrations pose potential human health risk.

## *Project Goal*

Develop a series of remedial alternatives to provide landowners, developers and public entities with practical methods to address mine waste contamination on their properties.

## *Project Objectives*

- Identify best practices to:
  - Reduce zinc and cadmium loading to Silver Creek to meet aquatic life standards (TMDL Report)
  - Reduce ecological risk by lowering lead concentrations in sediment (Richardson Flat ROD)
- Support Summit County's development of their Soils Ordinance (lead and arsenic)
- No net loss of wetlands (Army Corps of Engineers)

## Cleanup Options
*General Categories*

- Institutional Controls
- Containment/Collection
- Removal
- Treatment
- Resource Utilization

## Cleanup Options
*Institutional Controls*

Definition:

*Legal and/or physical restrictions ap plied to the Site that are intended to control or prevent exposure and/or access to contaminan t source areas.*

Examples:

Summit County Soils Ordinance

Irrigation Techniques & Diversions

## Cleanup Options
*Containment/Collection*

Definition:

*Physical measures appl ied to the sources and transport mechanisms to control the release of contaminants or to inhibit direct con tact or exposure.*

Examples:

Groundwater: Trenches/drains; impermeable barriers

Surface Water: Diversion ditches; bank stabilization; channelization

Mine Wastes: Revegetation; grading, capping

## Cleanup Options
*Removal*

Definition:

*Excavation of contaminant sources followed by transport and disposal at a different location.*

Examples:

Removal & Transport: limited options

Disposal: onsite versus offsite

## Cleanup Options
*Treatment*

Definition:

*Physical or chemical measures applied to sources or impacted waters to reduce the toxicity and/or mobility of contaminants.*

Examples:

Mine Wastes: Soil amendments (in conjunction with revegetation)

Water Treatment (passive): Constructed wetlands; subsurface reactive barriers; reservoir

## Cleanup Options
*Resource Utilization*

Definition:

*The use/reuse of the source material as a commercial product.*

Examples:

Reprocessing of tailings for metals recovery
- Dependent upon tailing mineralogy and economic feasibility

## Project Constraints

- Upstream Metals Loading
  - Water entering the Site exceeds aquatic life standards
- Water Rights
  - Potential for increase/decrease in water diverted around lower Silver Creek
- Wetlands Regulations
  - Remedial alternatives cannot result in a net loss of wetlands

## Data Requirements

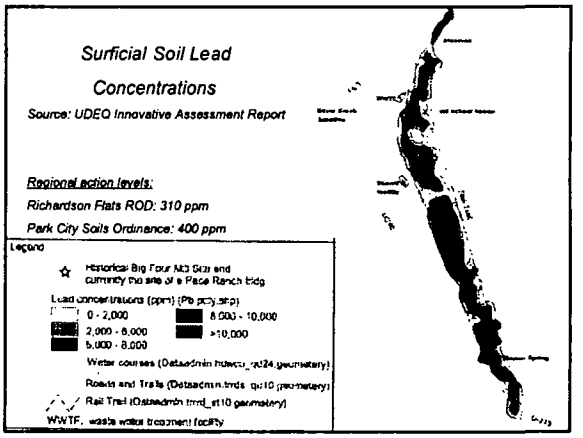
What Do We Need Data For?

- Define Nature & Extent of Contamination and Contaminant Transport Mechanisms
- Design
- Evaluate the Effectiveness of various Remedial Alternatives

## Data Requirements

Existing Information/Data:

- Mine Waste
  *UDEQ Innovative Assessment Report (2002)*
  - Metals concentrations in surficial soils in Silver Creek floodplain
- Surface Water
  USGS Tracer Dilution Study (2004)
  - Post spring runoff (high flow) conditions
  UDEQ Sampling (2006)
  - Fall (low flow) conditions
- Groundwater
  - None




## Data Requirements

Data Gaps

- Mine Waste/Upland Soils
  - Depth and volume of mine wastes in Silver Creek floodplain
  - Physical properties of mine wastes
  - Metals concentrations in upland area soils
- Surface Water
  - Fall (low flow) conditions
- Groundwater
  - Flow paths (water levels)
  - Chemistry

## Conceptual Monitoring Plan

- Two-Phased Monitoring Approach
  - Phase I – Characterization
  - Phase II – Detailed surface water, sediment, groundwater, and soil sample collection

Work performed in Phase I will be used to streamline data collection for Phase II

## *Conceptual Monitoring Plan*

- Phase I (August 2007)
  - 6 transects
  - Soil samples analyzed for lead, arsenic, zinc, and cadmium, nutrients, mineralogy, and engineering properties
  - Tractor-mounted drill rig used to assess depth of tailings
  - Small diameter monitoring wells
  - Rhodamine dye used to identify the main water course and mark sample stations for Phase II low flow study
  - Preliminary wetlands assessment

Tractor mounted direct push rig
- Collect subsurface samples
- Install shallow monitoring wells

## *Conceptual Monitoring Plan*

- Phase II (October/November 2007)
  - Surface water and stream sediment samples collected at stations marked during Phase I
  - Flow measurements
  - Additional soils analysis. Sampling depths and locations based on Phase I results.
  - Groundwater sampling from piezometers installed during Phase I

## *Conceptual Monitoring Plan*

Analyses
- Soil
  - *Nutrients, acid-base account, pH*
  - X-Ray Fluorescence used to measure Pb, As, Zn, and Cd
  - Grain size analysis, Atterberg limits, and moisture-density relationship
- Surface water
  - Total and dissolved metals
  - pH, major anions and cations
- Sediment
  - Total extraction to quantify total metals
  - Partial extraction to quantify labile metals
- Groundwater
  - Dissolved metals
  - pH, major anions and cations
  - Ferrous/Ferric Iron Ratio

## *Questions?*